

Title: Super-shortened Multiple-fold Umbrella Shaft

Background of the Invention:

U.S. Patent 6,035,873 to the same inventors of this application disclosed a multiple-fold umbrella having gradationally convex telescopic shaft consisting of a plurality of tubes telescopically engageable with one another, with the tubes gradually increasing their concave quadrants (V) inwardly for preventing twisting during folding or unfolding of the umbrella tubes.

However, this prior art has the following drawbacks:

1. The uppermost (or fifth) tube (10) has four concave quadrants (V), forming an air pocket (K) between a concave quadrant (V) of the tube (10) and a convex quadrant (X) of the upper tube (11) as shown in Figs. 21 and 23. If an innermost (or top) tube, a sixth tube, is inferentially formed within the fifth tube (10) to form a hexa-fold shaft, there will be presented with four concave quadrants (V) in the innermost tube. No air pocket is formed between the fifth tube (10) and the sixth tube, thereby causing a frictional contact between these two neighboring tubes and influencing a smooth operation when opening or closing the umbrella.
2. Each air pocket is formed between a concave quadrant (V) of an inner tube and a convex quadrant (X) of an outer tube, providing a space between any two neighboring tubes to easily cause

vibration of the tubes when extended for opening the umbrella.

3. The cross sectional shapes of all the tubes are different from one another. When assembling the plural tubes of the central shaft, it should be very careful for matching any two neighboring tubes to increase the production inconvenience.
4. The tubes are irregularly shaped with concave or convex structures, thereby affecting their ornamental effect.
5. Two stoppers ( $S_1$ ,  $S_2$ ) are respectively provided in two coupled tubes to prevent their separation, increasing the production complexity and cost.

The present inventors have found the drawbacks of the prior art and invented the present umbrella shaft overcoming the drawbacks of the prior art.

#### Summary of the Invention:

The object of the present invention is to provide a multiple-fold umbrella shaft including: a plurality of tubes gradually increasing diameter from the innermost tube to the outermost tube, and telescopically engageable with one another about a longitudinal axis of the shaft; each tube having a plurality of reinforcing ribs longitudinally formed, evenly distributed and radially recessed in a cylindrical tubular surface of each tube, with any two neighboring reinforcing ribs defining a central angle about the longitudinal axis of the shaft, which is equal to any other central angle defined

between any other two neighboring reinforcing ribs; whereby upon assembling of the plurality of tubes to form a multiple-fold umbrella shaft, an inner tube has its plural reinforcing ribs slidably engageable with plural reinforcing ribs of an outer tube disposed about the inner tube for preventing from twisting, vibration, deformation or damage of the umbrella shaft.

#### Brief Description of the Drawings:

Fig. 1 is a partially sectional drawing of the present invention when closing and folding the umbrella.

Fig. 2 is a cross sectional drawing of the present invention when viewed from line 2-2 of Fig. 1.

Fig. 3 is a perspective view of the umbrella shaft of the present invention.

Fig. 4 shows an opened umbrella of the present invention.

Fig. 5 is an illustration showing the coupling of an inner tube with an outer tube of the umbrella shaft.

Fig. 6 is a cross sectional drawing of the present invention when viewed from line 6-6 of Fig. 4.

#### Detailed Description:

As shown in the drawing figures, the present invention comprises a multiple-fold umbrella shaft 1 consisting of a plurality of hollow cylindrical tubes 11, 12, 13, 14, 15 and 16 telescopically

engaging with one another.

There are six tubes 11~16 as shown in the drawing figures telescopically engaged with one another to form a hexa-fold umbrella shaft 1. However, the number of tubes for making a multiple-fold umbrella are not limited in the present invention.

The innermost tube 11 is preferably formed as the uppermost tube; while the outermost tube 16 is preferably formed as the lowest tube having a grip or handle formed on the lowest tube. But the arrangement of the tubes 11~16 may also be inverted by forming the innermost tube as the lowest tube of the central shaft 1, not limited in the present invention.

The rib assembly 2 may be multiple folds, such as the penta-fold structure as shown in the accompanying drawings. Also, the number of folds of the rib assembly 2 are not limited in this invention.

Each tube of the plurality of hollow cylindrical tubes 11~16 as shown in Figs. 2 and 1 includes: a plurality of reinforcing ribs 10 longitudinally formed on a cylindrical surface of each tube. Each reinforcing rib 10 is radially inwardly recessed from a perimeter of each tube 11~16 towards a center of each tube or towards a longitudinal axis X of the central shaft 1.

Each reinforcing rib 10 has a curvature radius  $r$  which is ranging from  $1/2R$  to  $1/10R$ , wherein  $R$  is a radius of said innermost tube 11 when folding the tubes 11~16 for closing the umbrella (Figs. 2 and 1). Although the curvature radius  $r$  of the reinforcing rib 10 is not

limited in the present invention, it is preferably less than  $1/2R$ .

When closing the umbrella and folding all the tubes 11~16, all centers Y of the curvature radii r of the reinforcing ribs 10 of the tubes 11~16 are radially aligned to be a radial line  $L_i$  which is radially aligned with the longitudinal axis X of the central shaft 1 (Fig. 2). The longitudinal axis X is longitudinally aligned with all centers of the tubes 11~16.

All the reinforcing ribs 10 are symmetrically or evenly distributed on the perimeter of each tube 11~16 of the central shaft 1 in equal central angles C, every two neighboring reinforcing ribs 10 defining each central angle C about the center of each tube or about the longitudinal axis X of the shaft 1, with the central angle C defined between every two neighboring reinforcing ribs 10 being equal with one another.

When any inner tube has its plurality of (or four) reinforcing ribs 10 slidably engaged with a plurality of (or four) reinforcing ribs 10 of an outer tube neighbored to said inner tube for preventing twisting of the tubes about the axis X, the two neighboring tubes, i.e., the inner and outer tubes, will define a tiny annular aperture A between the two neighboring tubes to prevent from frictional contacting between the two neighboring tubes to enhance a smooth sliding movement of the tubes when folding or unfolding the tubes for closing or opening the umbrella. Since the annular aperture A provides a small "air aperture" (other than a big "air pocket" or "air

chamber”) homogeneously in between every two neighboring tubes, the shaft tubes will not be vibrated to prevent from vibrational deformation of the shaft after long-time service.

The tubes 11~16 have their reinforcing ribs 10 recessed inwardly towards the axis X (other than outwardly) without forming outwardly protruding ribs, thereby providing a smooth touch feeling whenever contacting the tube surfaces by the umbrella user, without injuring the user’s hand. Also, the smooth cylindrical surface of each tube, except for the small recessed ribs 10, may enhance an ornamental effect of the umbrella shaft.

The reinforcing ribs 10 of the shaft tubes may also serve as “guiding rails” for slidably guiding the extending (unfolding) or retraction (folding) of the tubes with one another to enforce the operational smoothness when opening or closing the umbrella.

The ribs 10 are served to reinforce the mechanical strength for each tube so that the tube may be made as thin as possible to decrease the total weight of the umbrella for making a compact foldable umbrella easily and conveniently carried or stored, while still causing no bending or deformation of the umbrella shaft.

When assembling the tubes 11~16 for producing a multiple-fold umbrella, each tube has a same cross sectional shape, namely having four reinforcing ribs 10 distributed in equal central angles, so that any two neighboring tubes may be easily assembled by quickly or instantly matching the reinforcing ribs 10 of any inner tube with the

corresponding neighboring outer tube. Therefore, a quicker production assembly can be achieved and the production cost thereof may then be reduced.

An inner or upper tube may have its lower portion made to be larger; and an outer or lower tube having an upper portion thereof made to be smaller to couple with the larger lower portion of the inner (or upper) tube for preventing a separation or uncoupling of the two tubes when extended for opening the umbrella (detailed mechanism further described hereinafter).

The rib assembly 2 as shown in Figs. 1 and 4 for securing an umbrella cloth (not shown) thereon includes: a top rib 21 pivotally secured to an upper notch 20 formed on a top of the central shaft 1, a stretcher rib 22 pivotally secured to the top rib 21 and a runner 23 slidably held on the central shaft 1, a main rib 24 pivotally secured to the stretcher rib 22 and pivotally connected to the top rib 21 through an inner connecting rib 25, an intermediate rib 26 internally pivotally secured to the main rib 24 and externally pivotally connected with an outer rib 27, a tail rib 28 pivotally secured to the outer rib 27, a middle connecting rib 26a pivotally secured between the main rib 24 and the outer rib 27, an inner spring rib 24a slidably coupled with the main rib 24 by a coupling 29 having the inner spring rib 24a pivotally secured between the stretcher rib 22 and the intermediate rib 26, and an outer spring rib 27a slidably coupled to the outer rib 27 by another coupling 29a having the outer spring rib

27a pivotally secured between the intermediate rib 26 and the tail rib 28.

By the way, a rib assembly 2 of penta folds may be formed. In commensuration with the central shaft of six tubes, a multiple-fold umbrella having penta-fold rib assembly 2 and hexa-fold shaft 1 will be formed. Such a multiple-fold umbrella has been super-shortened to be a very compact folded umbrella.

The coupling 29 for slidably coupling the main rib 24 with the inner spring rib 24a as shown in Figs. 4 and 6 includes an upper enlarged portion for fastening therein the main rib 24 having a cross section of two-lope shape, and a collar 291 formed on a lower portion of the coupling 29 for slidably coupling the inner spring rib 24a in the collar 291. Simultaneously, another coupling 29a is provided for slidably coupling the outer rib 27 with the outer spring rib 27a.

When opening the umbrella as shown in Fig. 4, an elongate hook 20a as protruding downwardly from the upper notch 20 may be engaged with a hook slot 230 formed in the runner 23 for locking the runner 23 at an opening state of the umbrella. When closing the umbrella, a push button 231 is depressed inwardly to disengage the hook 20a from the slot 230 in the runner to unlock the runner 23 which will then be lowered for closing the umbrella as shown in Fig. 1.

As shown in Figs. 3~5, the locking and coupling mechanism for



preventing from separation or uncoupling of two neighboring tubes of the central shaft 1 when opening the umbrella is described hereinafter.

An innermost (or uppermost) tube 11 has its lower portion formed as an enlarged portion 111; and a tube 12, which is an "outer tube" corresponding to the innermost tube 11, has an upper portion of the tube 12 formed as a contracted portion 121 especially as shown in Fig. 5 to be engaged with the enlarged portion 111 of the tube 11 to thereby stably couple the tube 11 with the tube 12 without being separated or uncoupled when extending the tubes for opening the umbrella. A locking means L as shown in Fig. 5 is provided for helping a stable coupling of the two tubes.

The locking means L as shown in Fig. 5 includes: a plug P transversely formed in a lower portion of an inner tube of the central shaft 1, a locking ball B resiliently retained by a tension spring S retained within the plug P for normally urging the locking ball B outwardly to engage with an inner hole  $H_1$  formed in the inner tube (such as numeral "11") and an outer hole  $H_2$  formed in the outer tube (such as numeral "12") for coupling or locking the inner and outer tubes for stably positioning the inner and outer tubes as coupled or locked.

As shown in Fig. 3 (when extending the tubes 11~16 for opening the umbrella), the tube 12 has its lower enlarged portion 122 coupled with an upper contracted portion 131 of the tube 13; the tube 13

having its lower enlarged portion 132 coupled with the upper contracted portion 141 of the tube 14; the tube 14 having its lower enlarged portion 142 coupled with the upper contracted portion 151 of the tube 15; and the tube 15 having its lower enlarged portion 152 coupled or engaged with the upper contracted portion 161 of the tube 16.

The outermost or lowest tube 16 may be formed as cylindrical shape without any rib 10 to have a smooth cylindrical surface for enhancing ornamental effect and touch feeling.

The present invention is superior to any prior art because of the telescopic tubes of the umbrella shaft are made to have each tube evenly formed thereon with plural reinforcing ribs to have the following remarkable advantages:

1. No twisting or rotation of the tubes when telescopically engaged and operated for preventing deformation or damage of the tubes;
2. Vibration being prevented due to the tiny annular air aperture homogeneously defined in between every two neighboring tubes (or an inner and an outer tube) for smooth sliding telescopic operation;
3. All the reinforcing ribs (10) reinforcing the strength of the shaft tubes;
4. Smooth touch-feeling on the cylindrical surfaces of the tubes;
5. Better ornamental effect due to the smooth surface of the tubes;
6. Easier assembly of the tubes since each tube has a same cross

sectional shape for a quicker matching of any two neighboring tubes.

7. The tubes may be six or more so that the shaft length can be greatly shortened when folded for convenient handling or storage.

The present invention may be modified without departing from the spirit and scope of the present invention.